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Pruning Fruit Trees

By
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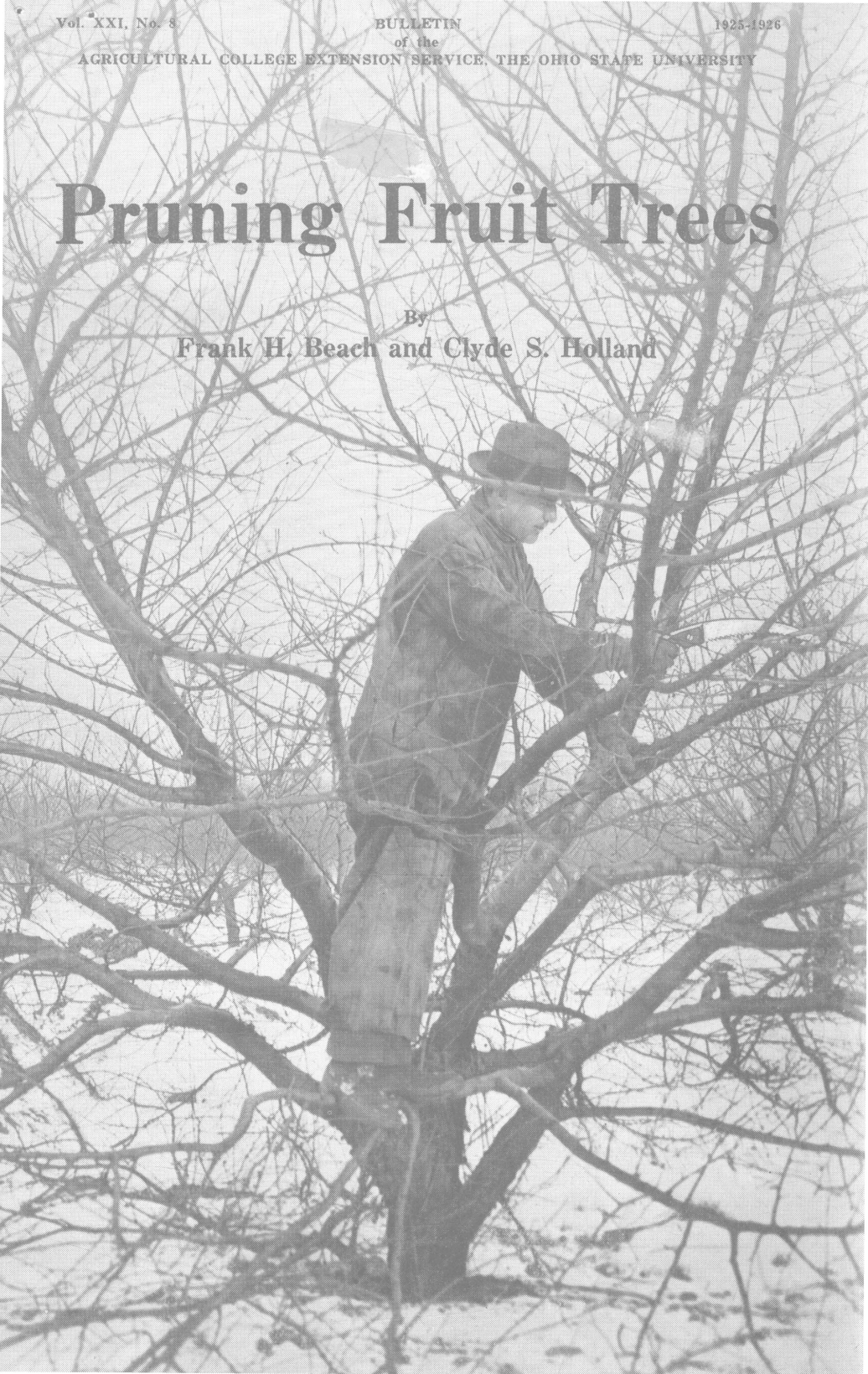

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Pruning Fruit Trees

By

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The kind and amount of pruning for trees is determined by their growth and fruitfulness. Heavy pruning dwarfs the trees and is undesirable for young trees that are not bearing. As trees reach maturity the amount of pruning may be profitably increased.

Fundamental Principles of Pruning

Relation of Growth to Fruitfulness.—There is a relationship between the roots and leaves of a plant that must be recognized in order to understand the results from pruning. Food material comes into the plant through the roots from the soil, and through the leaves from the air. From the soil come many chemical foods, but nitrogen seems to be the limiting one in tree growth. From the air come carbon and oxygen, which combine with hydrogen to form a class of compounds known as carbohydrates. These carbohydrates and nitrogen are combined in the leaves where, in the presence of sunlight, they are manufactured into the various kinds of foods used in growth.

Hence, to secure proper fruitfulness there must be a balance between the nitrogen and carbohydrates, or between food received from the roots and the leaves. If the material supplied by either the roots or the leaves is lacking, an unfruitful condition of the tree results. For example, if a tree is getting too much food from the roots or too little from the leaves its capacity for bearing fruit is impaired. On the other hand, if a tree is getting too little food from the roots or too much from the leaves, it is not sufficiently fruitful. The desired condition is where the food materials received through the leaves and roots are properly proportioned. Then the tree will be in the most fruitful condition.

Generally speaking, an over-vigorous tree is rarely found in practical orcharding except in the case of young trees just before coming into bearing. The under-vigorous tree is very often found. In fact, it exists in nearly all Ohio orchards that contain mature trees. The balanced and fruitful condition is the one toward which all growers should strive. It is found in the most successful orchards.

When trees are growing too much they are receiving too much food from the roots and consequently need reduced nitrogen feeding. Such trees also need all the food they can get through their leaves and should not have the leaf surface reduced by pruning.

When trees are not growing enough, they may have been injured or they are not receiving enough food from the roots. If they have been injured the first thing is to give the proper treatment to correct the condition. For example, trees defoliated by insects or diseases, or injured by borers, need treatment to control these pests. When trees have had their wood injured by winter freezing, the leaf surface will be much reduced, and no pruning, but heavy applications of nitrogen fertilizer, is needed. When healthy trees do not receive enough food from the roots, nitrogen fertilizers should be increased, and the trees might also be benefited by proper pruning.

Judging a Tree.—How can the condition of a tree be determined? By examining the past year's growth, that is, from the tip back to the first ring. If this growth is excessive, the food received through the roots is in heavier proportion than that received through the leaves, and as a result, the tree is not getting a balanced ration and is not fruitful enough.

On the other hand, if last year's growth is short and slender, the food from the leaves is too strong for that from the roots, and the plant is not sufficiently fruitful. If the growth is in between the two extremes it indicates a balanced condition and that the plant is in a fruitful stage.

Each plant, of course, has a certain normal growth. On a bearing apple tree, the desirable amount of annual terminal growth is usually about 10 or 12 inches of plump wood. On a peach tree it is greater. The most desirable amount of growth must be determined by experience.

Making the Cuts

Response to Cuts.—Pruning usually increases annual growth, but decreases the total size of the tree because the increased annual growth does not make up for the amount removed. Hence, the tree looks more vigorous but may actually be dwarfed. The increase of growth due to pruning is almost entirely in the immediate vicinity of the cuts and does not greatly affect the growth on other branches that are not pruned. Consequently, pruning can be used to dwarf a shoot and it can also be used to encourage new growth where it is desired.

Result of Heading Back.—When a young branch is left without any cutting, it normally continues its main growth from the terminal bud with a little branching near that terminal. If that same shoot is cut back several buds immediately below the cut are forced into active growth, and develop into a number of branches (see Fig. 1). The bud just below the cut will continue in much the same direction as the original branch was growing.

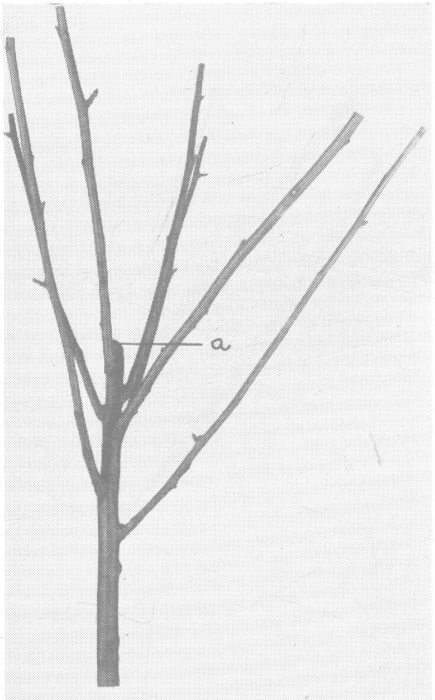


Fig. 1.—Result of a heading-back cut at *a* which forced buds just below the cut into vegetative branches. Cuts of this kind are desirable only where many branches are needed. Such cuts develop thick trees with much unproductive wood.

Heading-back cutting is of value in pruning the young tree to enable the grower to start the head where he desires. It is also of value on peach trees that have made a very vigorous growth.

A cutting back may dwarf, but at the same time it tends to place the growth where it is desired. The practice is sometimes resorted to as a help in shaping the tree.

Cutting to Lateral Branches.—Lowering or shortening a limb by cutting to a lateral branch does not seem to start out quite as

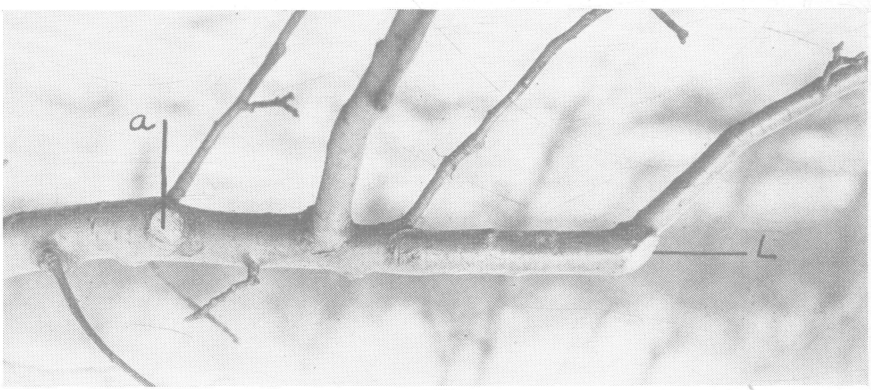


Fig. 2.—Cutting to a strong lateral, as at L, is the most desirable method of shortening a limb. the cut at (a) where a side branch has been removed is properly made.

many side branches as does heading back. Also it does not seem to dwarf as much, particularly if the lateral is a strong growthy branch of about the same size as the main branch. As a result, cutting to laterals can often be made to shape and train a tree without securing the great number of side shoots and branches that result from a heading-back pruning. It seems probable that a peach grower could cut to side branches on bearing trees more often than is commonly the custom (see Fig. 2).

Fig. 3.—The result of allowing a weak fork at the head to remain uncorrected. If the left limb of the fork had been removed or cut back heavily to a lateral when the tree was young, this weakness would have been corrected.

Correction of Weak Crotches.—When two branches come out at the same place and are of the same size they will eventually form a very weak crotch (see Fig. 3). If one of these two is cut back, it becomes dwarfed, while the branch unpruned grows at the usual rate. The result is that the dwarfed branch becomes the side branch and the unpruned one becomes the main limb. Such a crotch is not weak. The most desirable method to handle forks is to cut off entirely the poorer branch.

Pruning Young Trees

Pruning in Relation to Growth.—Young trees often have an over-vigorous growth which indicates that the root system feeds the plant too much, or, to say it in another way, the leaves do not feed it enough.

Pruning in such a case removes some of the already deficient leaf surface, retards root growth, and dwarfs the tree. This is true even though the annual growth is increased because the increase is not enough to make up for the amount removed plus the normal growth.

Heavy Pruning of Young Trees.—That heavy pruning dwarfs trees and delays the time of bearing has been shown by experiments in Ohio and many other states. In one plot at the Ohio Experiment Station several apple trees, as nearly alike as possible, were set out at the same time. Some were pruned heavily, some lightly, and some not at all. In every case the heavily pruned trees were smaller and did not come into bearing as early as did the lightly pruned and unpruned trees.

Unpruned Young Trees.—The unpruned trees in this experiment were larger than those heavily pruned, but they were of ungainly appearance before the first crop. Their limbs were pulled outward and downward by the weight of the crops and were soon as low as was desirable.

Light Pruning of Young Trees.—The lightly pruned trees had all the advantages of size and early bearing of the unpruned trees and, at the same time, the scaffold limbs were well placed with no weak crotches. Details of this pruning are given under the different fruits.

Pruning Bearing Trees for Fruitfulness

Terminal Growth.—As the trees come into bearing, the production of fruit and the increasingly large top change the relationship of the parts of the tree. Annual growth becomes less with each succeeding year until in a short time it affects fruitfulness Pruning and the application of fertilizers then become necessary to keep the annual terminal growth at the right stage and to keep up fruitfulness.

Fruit Spurs.—Fruit spurs must be kept in a vigorous condition. In the same way that the medium terminal growth is the

most fruitful, the medium-sized fruit spur is also the most fruitful. In old trees, the fruit spurs are often undersized, and annual pruning with cuts well distributed is needed to keep them up to the proper growth standard.

Individual fruit spurs on an apple tree do not bear every year.

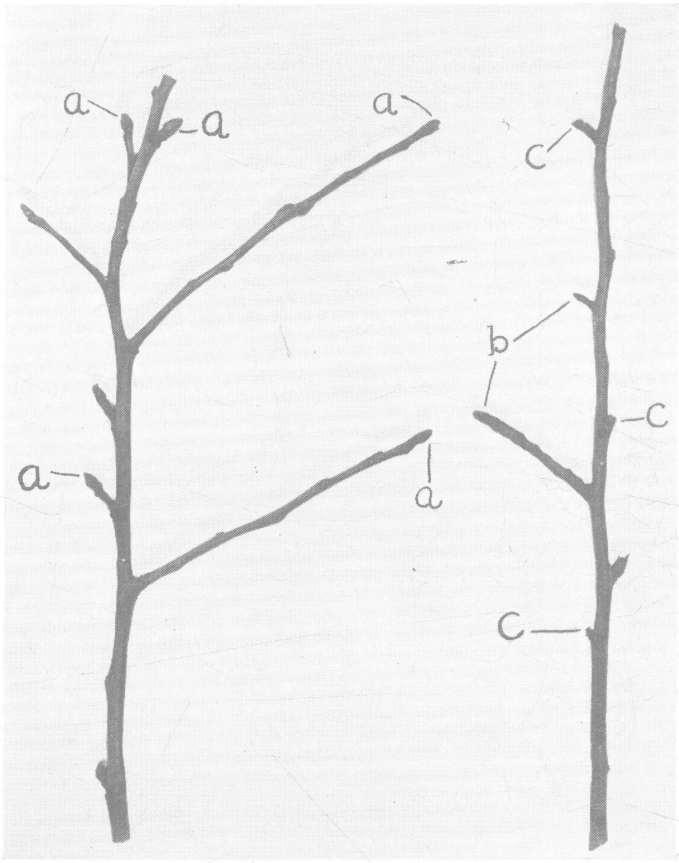


Fig. 4.—A bud study of apple wood. The buds *a* are large and strong and are probably fruit buds. Buds *b* are small and pointed and are probably leaf buds. Where there are three or more large, healthy leaves on the spur to feed it, buds like *a* develop. Where there is a small leaf surface attached to the spur, a bud like *b* develops. Where there are no attached leaves on the spur, the buds die out as at *c*.

One year a spur bears. The next year this spur usually develops another fruit bud. Thus each spur usually bears biennially.

Some trees tend to grow spurs that are all uniform in growth, and all bloom and fruit together in the same year. Such trees are biennial bearers.

Other trees grow fruit spurs of unequal length. As a result, only a part of these spurs bloom and fruit together one year, while some of the others bloom and fruit the following year. Such trees are annual bearers.

Still other trees fruit largely from terminal buds and are annual bearers, because terminal fruit buds are usually formed every year. An example of this type of tree is the Rome.

Varieties that tend to have fruit spurs of uniform length and to be biennial bearers are: Baldwin, York, and Wealthy.

Varieties that tend to have spurs of unequal growth and to be annual bearers are: Jonathan, Grimes, McIntosh, and Ben Davis.

Other varieties lie between these two groups. When properly grown they are annual bearers, but they easily become biennial as they grow older or as cultural treatment becomes insufficient.

Adequate nitrogen feeding and well distributed pruning throughout the fruit spur system can develop unequal spur growth so that biennial bearing varieties tend to become annual. An increase of pruning and feeding should be made in the winter and spring following the crop. This will make some spurs so strongly vegetative during the off-year, that an unequal blossoming takes place. This tends to make an annual bearing tree.

Even in annual bearing trees pruning and feeding is necessary to keep spurs of unequal growth and the trees in an annual bearing condition. Particularly is this true as the trees grow older.

Thinning-out Pruning.—Usually, the different buds on a fruit spur are alike at the start. Whether they become fruit buds, leaf buds, dormant buds, or dead buds depends on the food they get. The buds with one leaf seldom get past the leaf-bud stage, but with three or four large, strong leaves on a spur, the adjacent bud usually develops into a fruit bud. For this reason, it is necessary to have large, strong leaves on the fruit spurs. To secure such leaves, it is important that plenty of sunlight reaches them. Pruning should, therefore, thin out the surplus limbs so that sunlight can reach the remaining leaves on the fruit spurs.

Other Benefits of Pruning the Bearing Trees

Pruning the bearing tree is done to improve the quality as well as to increase the quantity of fruit. Pruning improves color, assists in controlling insects and diseases, increases size of fruit, improves the quality, and keeps fruiting wood on old trees vigorous.

Improves the Color.—Color on the fruit cannot be expected where the tree is too thick to let in sunlight and air. The amount

of color on the fruit can be increased in two ways, as follows: (1) Take away the food from the roots and prevent such vigorous growth; (2) take away some of the leaf surface by pruning.

Examples of the first method to secure color are frequently seen with stunted trees on poor soil. They usually have well colored fruits but not many of them. Their leaf surface on the fruit spurs is so slight that the fruit buds are not as fruitful as they should be. In the second case, the leaf surface is large enough to make the spurs fruitful but shades the fruit so that it does not color properly. Pruning removes surplus weak limbs and leaves,

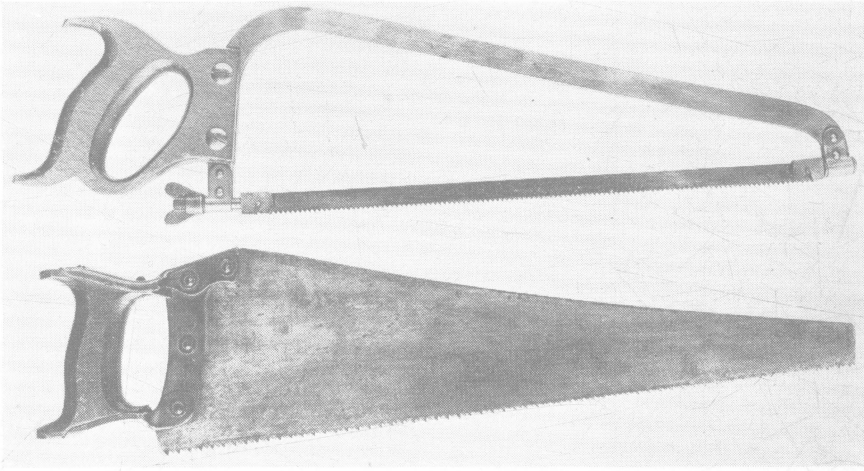


Fig. 5.—The swivel-bladed saw will make proper cuts in tight places. In large limbs the blade is apt to turn and not work right. The straight saw is adapted to heavy cutting. *(Courtesy United States Department of Agriculture.)*

allowing the fruit on the remaining branches to receive plenty of sunlight, which develops fruit of high color.

Pruning, then, should be used to help produce a higher color on the fruits where this color is of importance. With the Rome Beauty, Jonathan, or any of the red apples, high color is one of their best selling points. With green or yellow varieties, pruning for color is not necessary but should be done for size and quality.

Along with the great increase in the use of nitrogen fertilizers in Ohio orchards there has not been a corresponding increase in pruning. As a result many growers have noticed a continued increase of green and poorly colored fruit which proper pruning could prevent.

An example of the need of increased pruning when the nitrogen feeding is increased is seen by a fertilizer demonstration in a mature Rome Beauty orchard in Lawrence County, Ohio, put on by the Agricultural Extension Service. After three years of varied nitrogen feeding along with uniform pruning, it was clearly evident that more pruning was needed when the heavier nitrogen feeding was done. Trees that had received twice the normal amount of nitrogen for the past three years, produced in 1924 542 pounds per tree, of which only 30 percent was of the Ohio A grade. Trees

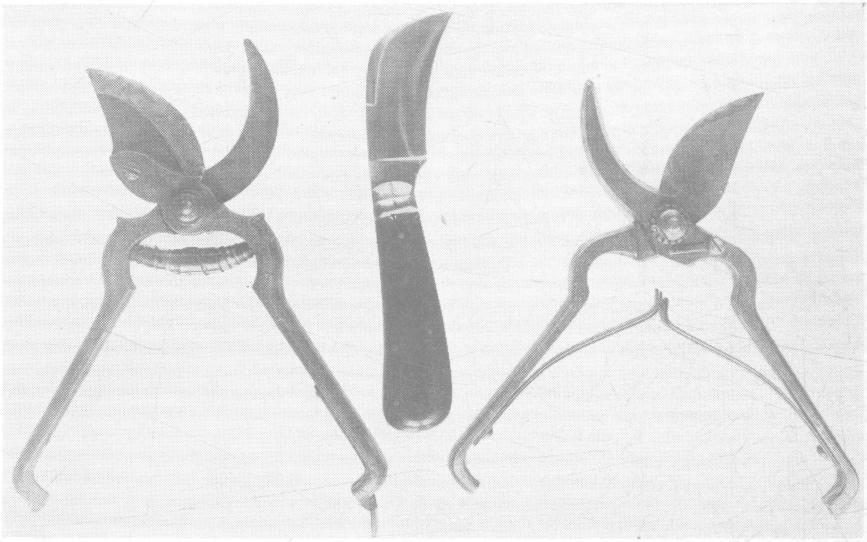


Fig. 6.—Desirable tools for light pruning and small cuts. A pruning knife is liked by many for work on nursery trees and very young orchard trees. Branches soon get heavy enough to demand hand shears. *(Courtesy United States Department of Agriculture.)*

that had received the normal amount of nitrogen fertilizers averaged 338 pounds, of which 36 percent was Ohio A grade. Those receiving half the normal rate yielded only 191 pounds of fruit, of which 59 percent was Ohio A grade.

Since this difference in grade was largely due to color, it can be seen that heavier nitrogen fertilizer applications reduce the percentage of well-colored fruits. However, the amount of A grade fruit was increased by the heavier applications because a much larger crop was grown. In this demonstration the normal application of nitrogen fertilizer was 5 pounds of nitrate of soda per tree or its equivalent in other carriers of quickly available nitrogen.

Had the heavier fertilized trees been pruned proportionately more, it is highly probable that the percentage of A grade fruit could have been considerably increased without seriously reducing crop yield. This would have been a more profitable practice than the uniform method of pruning that was followed on these Rome Beauty trees.

Relation of Nitrogen and Pruning to Grade

	Total yield per tree, pounds	Average yield per tree in pounds by grade, and percentage of total 1924 crop		
		Ohio A	Ohio B	Culls
Double normal nitrogen fertilizers .	542	162 lbs. 30%	315 lbs. 58%	65 lbs. 12%
Normal nitrogen. . .	338	122 lbs. 36%	192 lbs. 56%	24 lbs. 8%
Half normal nitrogen. .	191	113 lbs. 59%	69 lbs. 36%	9 lbs. 5%

In 1925, the owner of a 15-year-old Rome Beauty orchard near Steubenville found that the quality, color, and size of his fruit was not as good as it had been when the trees first started to bear. To show the increase in quality from pruning the Extension Service pruned some trees in his orchard and left some unpruned. From the pruned trees 444 pounds were harvested, of which 80 percent were A grade. From the unpruned trees 417 pounds were picked with 63 percent A grade. The table is as follows:

Effect of Pruning on Grade

	Total yield per tree pounds	A Grade		B Grade		Culls	
		Pounds	%	Pounds	%	Pounds	%
Pruned ..	444	352	80	40	8	52	12
Unpruned .	417	264	63	58	15	95	22

The Ohio A grade as packed by the Cooperative Associations in Ohio calls for Rome Beauty apples that have 25 percent color. Anything having less red color than this amount is B grade. In this demonstration, the trees were well sprayed and the fruit from all trees was very clean. However, from the pruned trees there were more apples that passed the color requirement than from the unpruned trees.

Pruning Aids in Controlling Pests and Diseases.—Better control of fruit pests is another result that can be obtained from proper pruning. Where the branches are thick and matted it is almost impossible to apply a thorough coating of spray material. The result is poor control of pests. Dense growth increases humidity in the tree, allowing most fungi to thrive.

Pruning secures good penetration of light and circulation of air through the branches, decreasing humidity so that fungi do not thrive as readily. This fact is especially true with regard to the apple scab fungus, which germinates in wet weather very easily. Thick, dense, humid places do not dry out, and so present ideal conditions for disease development.

If all cankers are removed, diseases like blight can usually be kept under control. This disease winters over as a canker on large limbs. Pruning out the cankers helps to keep the disease in check.

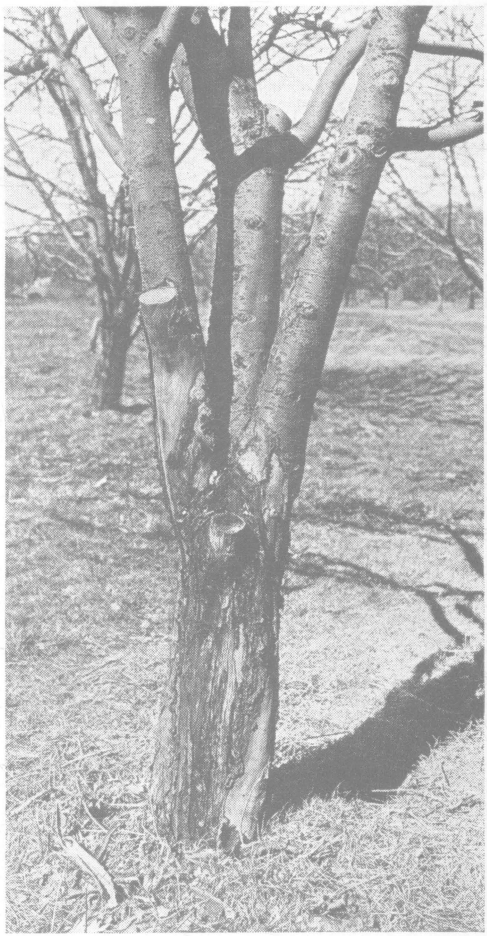


Fig. 7.—A stub left in pruning will not heal. Notice the healed cuts on the right limb. They were all made close and smooth. *(Courtesy United States Department of Agriculture.)*

Example. — An illustration of the benefits of pruning as an aid to spraying can be seen in results from the Apple Blotch Control Demonstrations that were staged in southwestern Ohio by the Extension Service. The report of results from these demonstrations says, "The trees in the demonstration plot of the Perrin orchard

were sprayed with considerable difficulty owing to their lack of proper pruning. The fruiting branches had matted together, making it tedious and difficult to give thorough spraying. This condition also necessitated the use of an excessive amount of spray material. The spraying could have been given in half the time had the trees been properly thinned out by judicious pruning beforehand."

Pruning Increases the Size of Fruit.—Some trees like the peach sometimes set such a heavy crop that the fruits will not become large enough unless they are thinned in some way. If such trees are properly pruned some of this thinning will have been done with shears, so that less hand thinning is necessary. The number of fruits that set on the tree will be lessened by pruning, and the size of each specimen will be so increased that there will be as great a total yield as if the fruit had not been thinned. Certainly, the increased size of the fruits will be enough to make the crop more profitable than a large crop of small fruits.

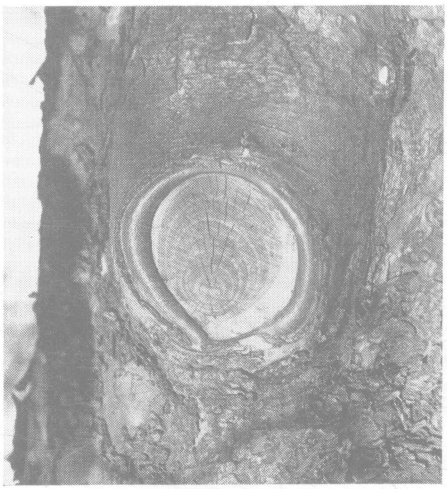


Fig. 8.—A close-pruning cut healing satisfactorily.

With some crops like the grape an unpruned vine will produce more pounds of fruit for the first year than a pruned vine, but in the succeeding year it will produce less than the pruned vine. Likewise, the quality and size of bunch is so inferior both years that the pruned vine is far more valuable.

In California and other western fruit sections many growers of stone fruits changed from an annual heading back to a thinning-out type of pruning. They did this after experiments had shown a higher yield in favor of the thinning-out pruning. However, these men had never hand-thinned their fruit when they headed back in pruning, but when they adopted the thinning-out system, they found hand-thinning very necessary. Then comes up the economic question as to whether the increased yield was enough extra to pay for the cost of hand-thinning.

Example.—In Lawrence County many growers had an adage "Never put a knife on a Rome Beauty apple tree." Their trees were dense and heavy and were not able to produce high quality apples. In 1918, the Extension Service pruned some 31-year-old Rome Beauty trees in the orchard of W. A. Knight of Athalia to show the results of proper pruning. These trees were very dense, and branches in the lower part of the trees were deeply matted.

The pruned tree produced 19.8 bushels, while the unpruned tree produced 16.2 bushels. In addition to the extra quantity, the size of the fruit was increased so that it was more valuable. On the pruned tree, there were 13.5 bushels or 68 percent over 2¾ inches in size, while on the unpruned tree there were only 8.95 bushels, or 55 percent, of the same size. The table is as follows:

Yield of Pruned and Unpruned Trees (Bushels)

	Total yield	2¼ inches	2½ inches	2¾ inches	3 inches and up	Culls
Pruned	19.8	0.5	3	6	7.5	2.8
Unpruned	16.2	1.0	4.15	4.5	4.45	2.1

The next year a larger plot was taken in Mr. Knight's orchard. Ten rows of 214 trees were pruned and ten rows of 202 trees were left unpruned as a check against the work. From the pruned trees 498 barrels were picked and from the unpruned trees only 241 barrels, or about half as many, were harvested. When the fruit was packed for market it graded out as follows:

Yield of Pruned and Unpruned Trees by Grades

	Total barrels	No. 1 Grade barrels	No. 2 Grade barrels	Culls barrels	Drops barrels	Cider barrels
Pruned	498	413	4	51	19	11
Unpruned	241	193	0	26	14	8

Pruning for Quality.—If quality is the principal factor, the grower must prune heavily enough to secure well colored and large sized fruits and to permit thorough spraying. He must, in turn, take into consideration the annual growth of his trees, and either fertilize or prune enough, or both, to keep them in the most fruitful condition.

Keeps Fruiting Wood on Old Trees Vigorous.—On young trees that have just come into bearing all conditions seem to be at the best. Almost every observer has noted the fine size, color, and quality of fruit that comes on trees of this age. Then little pruning is needed, but in one or two years the conditions change slowly to a lesser growth, thicker top, less color, smaller sized fruit, and less perfect control of the orchard pests.

Both pruning and fertilizing must be practiced in order to keep the mature trees in the ideal condition generally found in young trees.

Season for Pruning

Old horticulturists often advised, "Prune whenever the knife is sharp," and they could make the same statement today. Usually, most growers prefer to prune in the dormant season, because that is the time when other orchard operations are less pressing and because at that time the branches can be more easily seen than when they have leaves on them.

The New York Experiment Station reports that there was no difference in fruitfulness resulting from either winter or summer pruning. However, they point out that winter pruning must be compared with the summer pruning of the season just previous. If that is not done and the winter pruning is compared with pruning during the following summer, there is a season's growth in between and the yield from the summer pruned trees is greater.

They also point out that it is difficult to estimate an equal amount of wood that is being removed in the two different seasons. In the summer time the branches are full of sap and thick with leaves and as a result, the average man will remove less wood in that season. When this is the case the lighter pruning in the summer often furnishes a higher yield.

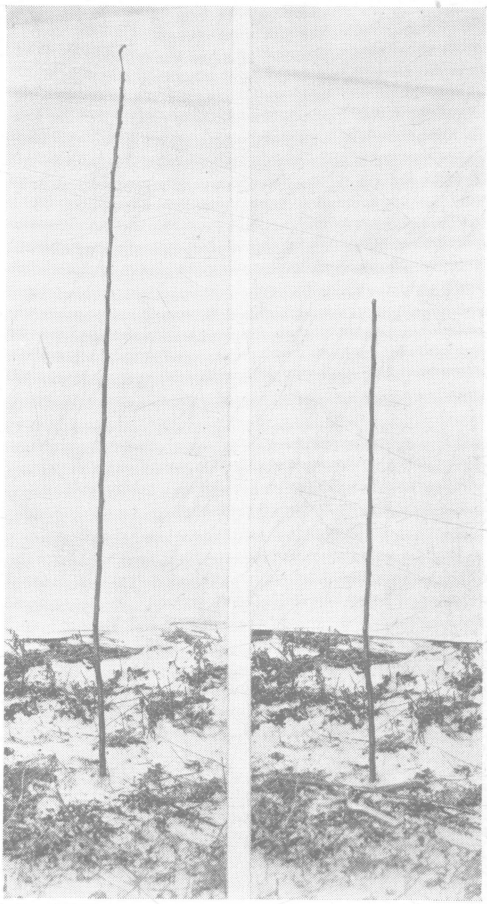
There is a very definite place for summer pruning with some young trees. It often helps develop fruit buds in a rank growing peach tree which hastens early bearing. Details of the method will be discussed under peach pruning (see pages 28-32).

Pruning the Young Apple Tree

In buying apple trees from the nursery, it is always best to get those of the first grade, either one or two years of age. Thrifty trees will usually make a better start and give a higher stand of live trees to the acre than those of the lower grades.

Pruning 1 - Year - Old Trees at Planting Time.—When nursery stock is dug, a large part of the root system is left in the ground and the balance between roots and tops is destroyed. Since this balance is necessary for proper growth, the only possible method of restoring it again is to remove a part of the top to correspond with the loss of the roots.

All the first growth in the spring takes place at the expense of plant food stored up in the buds, branches, and roots. The buds open up in the spring as soon as the air becomes warm, and soon begin to draw on the root system. The larger the number of buds that draw on the root, the larger will be the drain. Hence, proper pruning reduces the number of buds so that the plant will get a balanced ration of both the leaf and root food. A 1-year-old tree has a straight shoot for a top which should be cut back at planting time so that the future head will form below the cut (see Fig. 9). This is usually 2½ to 3 feet above the ground. The first limb should be about 2 or 3 feet from the ground.

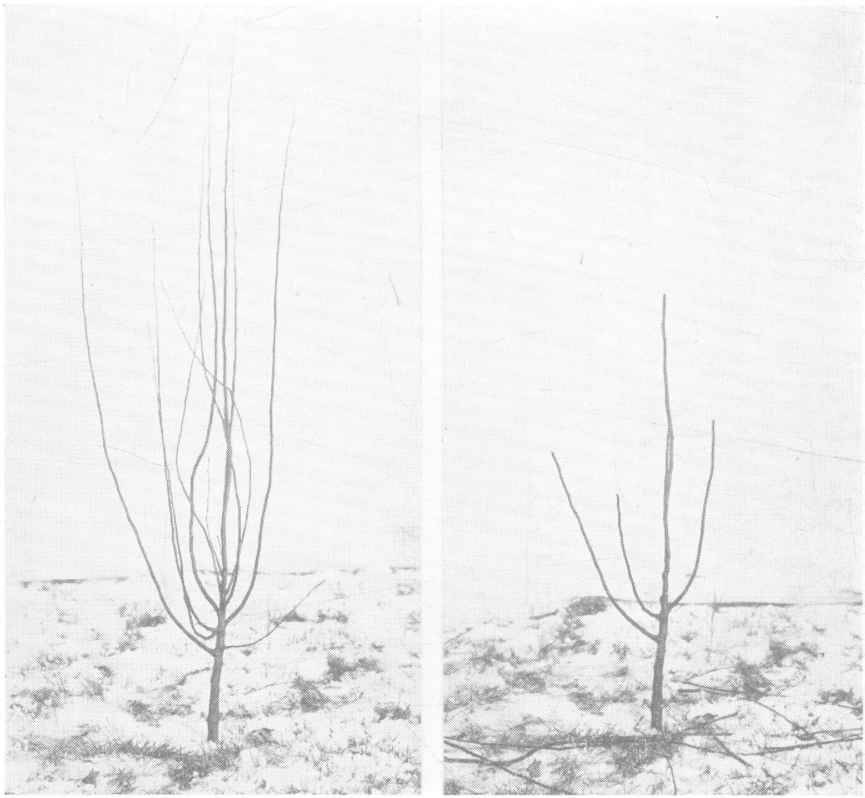


(a) *(b)*

Fig. 9.—*(a)* One-year-old apple tree as it comes from the nursery before pruning. *(b)* Same tree after pruning. Top has been cut back to 30 inches.

The next season this 1-year-old tree will begin to branch out and form scaffold limbs. The modified central leader type of training has proved to be the most desirable and makes the strongest tree (see Fig. 10).

This type has one strong central branch around which the scaffold limbs are spaced. The central branch is the dominant



(a) *(b)*

Fig. 10.—*(a)* Two-year-old apple tree after planting. *(b)* Same tree after pruning. Branches have been thinned out to leave a modified leader and well-spaced side branches. The side branches have been cut back about half their length while the leader has been left somewhat longer to make it the dominant limb.

branch in the tree and, in pruning, it should always be allowed to have the lead while the tree is young. Side branches can be taken from the leader to form the scaffolds of the tree as rapidly as they become available. After the trees reach bearing age, the leader can be modified to form a spreading top. This is usually taken care of by natural means as the branches fruit.

Pruning 2-Year-Old Trees at Planting Time.—If 2-year-old trees are bought at planting time, their training, of course, starts with that of the 1-year-old tree at the second pruning except that the side limbs are headed back to about half their growth and the central leader is cut back so that it is longer than the others. This cutting back is done to equalize the tops and roots as was described for setting of 1-year-old trees.

Select the leader and from three to five scaffold limbs well spaced around the tree so that they make a framework for all sides. Pick, if possible, these branches well spaced vertically on the trunk so that each one is at least 6 to 8 inches away from any other at the point of origin on the trunk. This arrangement is the most important thing about training a young tree, because when several branches come out from the trunk near each other in a whorl, they are usually weak. (Fig. 13 shows this in a mature tree.) Well spaced branches make a strong tree.

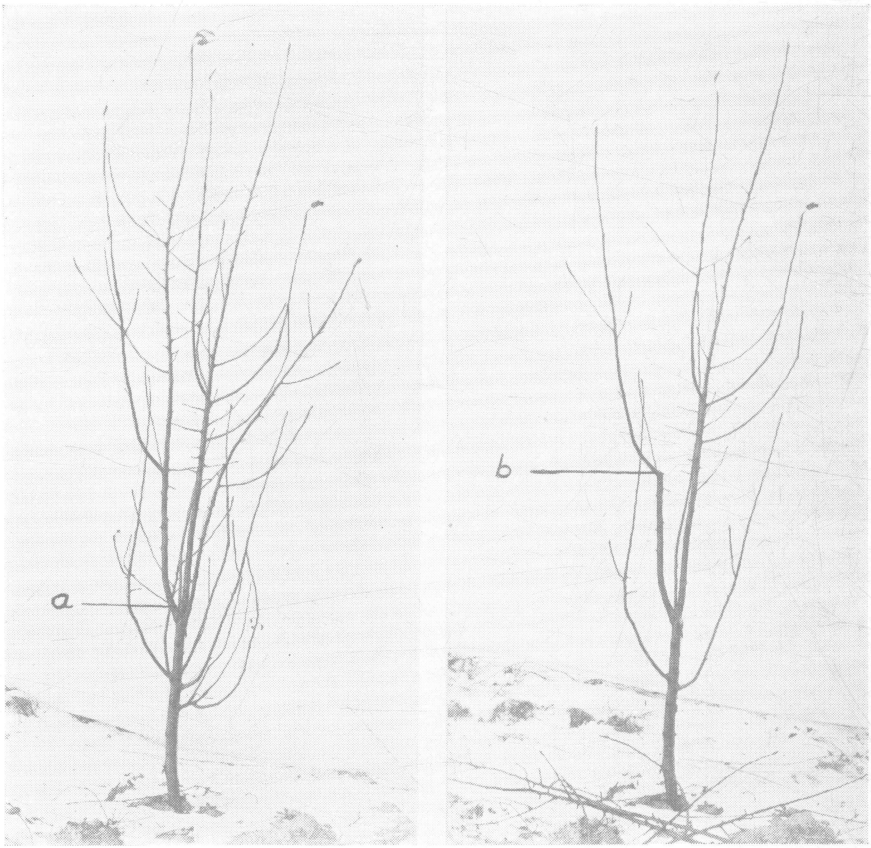
As the tree grows the distance between branches does not grow greater, but the limbs grow larger in circumference and intensify any original weakness. If the proper scaffold limbs cannot be selected in one season take another year or more to do it. Many 2-year-old trees do not have enough good branches to choose from. In such cases, select the leader first and then get three or four well spaced scaffold branches as they appear.

Pruning Young Growing Apple Trees.—For trees that were set as 1-year-olds and have been grown a year in the orchard, the central branch must be left a little longer than any of the scaffold limbs. If it is not longer, repress the laterals by heading back cuts. If the tree has made excessive growth of from 4 to 5 feet in the past season, the branches should be shortened by cutting in order to induce branching near the trunk. Otherwise, no heading back is needed.

In the succeeding years the orchard must be gone over annually for light corrective pruning and to continue the proper training. Often, this pruning will be the continual selection of scaffold branches till the proper ones are secured, keeping limbs from crossing one another or the prevention of weak forks. (Fig. 11 shows method of prevention.) The pruning of young trees, of course, should help shape the plant when possible, but all pruning must be very light and if the reason for making a cut is at all doubtful the cut should not be made.

Points to Remember.—In summing up the suggestions for pruning young apple trees consider the following points:

1. Prune to aid growth just after planting time.
2. Train to modified central leader type.
3. Carefully select scaffold limbs so that they start from places on the trunk at least from 6 to 8 inches apart.



(a) (b)

Fig. 11.—*(a)* Young apple tree before corrective pruning. The two main branches have formed a weak fork at *a*. *(b)* Same tree after corrective pruning. One of the main branches has been cut back heavily at *b* to a desirable lateral. The pruned branch will gradually develop as a side limb, correcting the weak fork.

4. Do not head back except to repress excessive growth, form new branches, and to prevent the formation of crotches and forks.
5. Prune lightly—if in doubt about what to cut don't cut.
6. Fertilize, if necessary, in cultivated orchards and always in sod orchards to keep up growth. Remember that a tree must develop bearing wood before it can fruit.

Pruning Bearing Apple Trees

Soon after the trees come into bearing, it becomes necessary to help keep up the annual growth by pruning and by the use of nitrogen fertilizers. To do so with fertilizer alone makes the tree so dense that the fruit does not have as good color, quality, or size

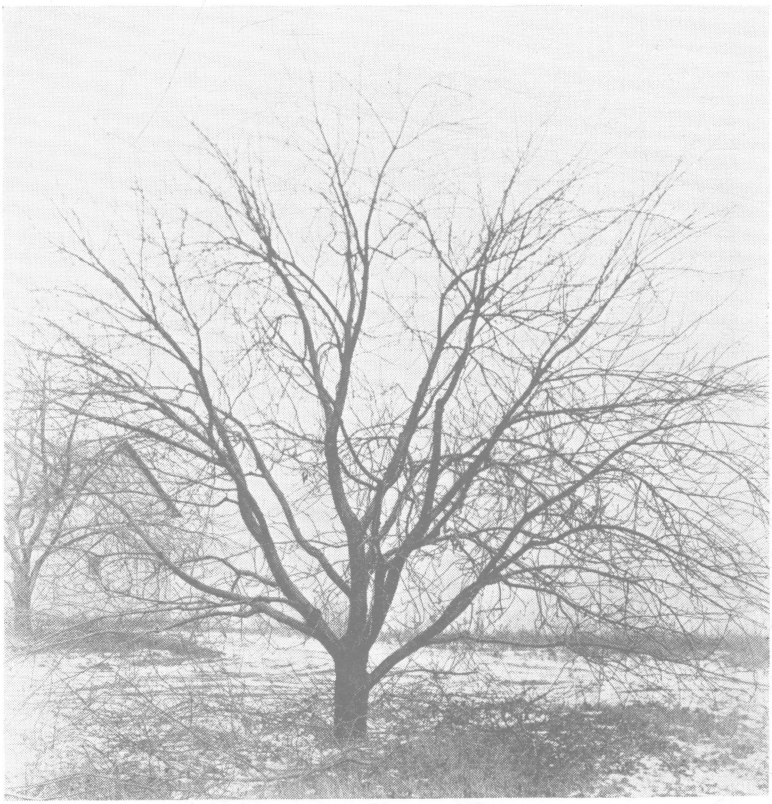


Fig. 12.—A well-pruned Rome Beauty apple tree trained to a modified, central leader with strong, well-spaced, side branches.

as it does when the trees are handled with a well rounded program of both pruning and fertilizing.

System in Pruning.—Few growers pay sufficient attention to the details of the various orchard operations. In pruning mature apple trees, one should use a definite method of procedure with every tree. Then, if extra help is hired, good results can be secured from their work.

With bearing trees the pruner should use the following methods.

1. Remove dead or diseased wood.

2. Do any corrective pruning and take out any large limbs necessary to improve the shape of the trees.

3. Start at the top of the tree to do the first thinning out pruning and work down.

4. Always begin at the tips of the branches and thin them. Then work back along the limbs, distributing the cuts so that the remaining wood is well spaced and secures plenty of light.

5. Remove water sprouts unless they can be used to fill a space in the tree to advantage.

Corrective Pruning.—Corrective pruning is necessary only where trees have been allowed to go for some time without proper attention. In such cases, large limbs must be cut in order to correct the shape or form of the plant and properly to space and distribute the large wood. (Compare Figs. 16 and 17, and note improvement in pruned tree.)

Pruning for Fruitfulness.—Apple trees bear most of their fruit on spurs on wood 2 years or more in age. Cutting back does not let much light in on such wood As a result, pruning of these trees must be entirely a *thinning-out process,* with practically no cutting back of branches.

In thinning-out branches, cuts should be made in wood 2 or 3 years old so that the remaining fruit buds may be benefited. Very little cutting of 1-year-old branches should be done.

A few rules as to what to cut follow.

1. Remove all dead or broken branches.

2. Remove all cankered or diseased limbs.

3. When branches cross each other, one of them should be removed or shortened to a lateral so that they no longer interfere.

4. Where branches are closely parallel, one or more can well be cut out. When these occur in pairs the weaker or less desirable limb is the one to come out. When there are three parallel branches it is usually the center one that can best be spared.

5. Never remove extremely large limbs of trees except for the purpose of correcting the shape or form. Removal of large limbs that let in the direct rays of the sun on branches previously shaded causes sunscald and canker of the exposed limbs and often forces out an objectionable sucker growth.

6. Cuts must be made close, smooth, and parallel to general direction of the limb from which the branch is being removed. In making large cuts these precautions are very important to secure proper healing and to prevent decay.

7. When watersprouts or suckers occur most of them should be removed, but their presence in large numbers indicates too heavy pruning or at least pruning of the wrong kind. When a large opening occurs in a tree, it can sometimes be filled by allowing a

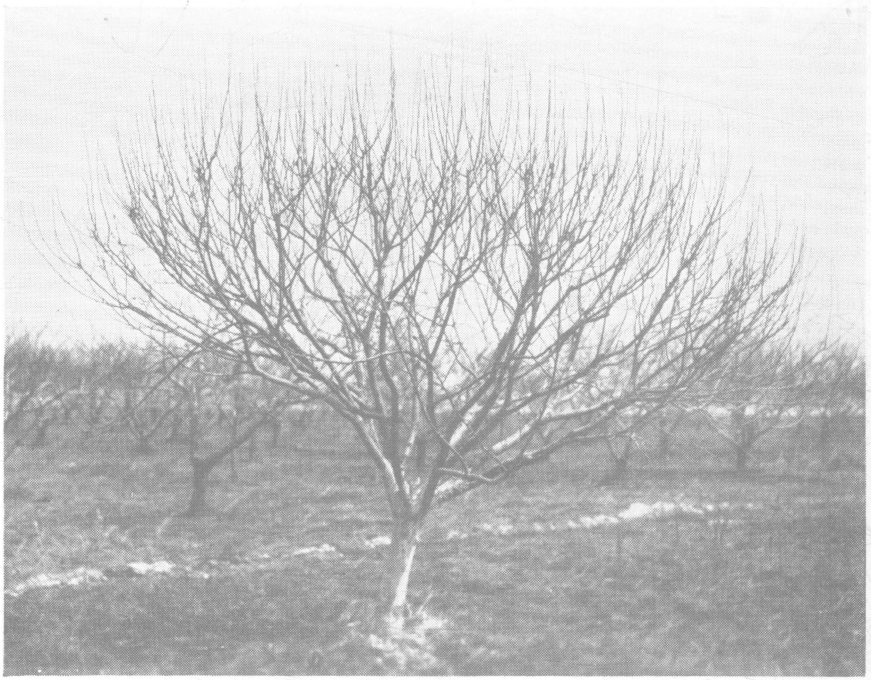


Fig. 13.—Apple tree ruined by continuous improper pruning. The main branches start in a whorl forming a weak head. Annual heading-back pruning has multiplied branches until the top resembles a hedge and practically no fruiting wood is present. *(Courtesy W. F. Rofkar.)*

few well spaced water sprouts to grow. They can be cut back to suppress extremely vigorous growth and to cause branching at proper places, after which the pruning should be the same as for the rest of the tree.

Pruning for Shape of Tree.—Quite commonly a grower who is dealing with young bearing trees worries a lot about them, because they seem to be growing too tall. Frequently he does not realize that a good crop of fruit will bend the limbs down so that the trouble is corrected naturally and at the same time fruit of high

quality is produced. Depend entirely on *thinning* to keep a tree low. This allows the lower branches to keep up with the upper ones and produces continued fruitfulness.

After bearing several fruit crops, the lower branches mat together and present a problem in thinning-out pruning. If this pruning is not done much of the low wood becomes weak, and under-vigorous. In pruning, the weaker, lower, and inner wood is removed. Trees are preferably pruned so that when the branches

Fig. 14.—Bearing apple tree before the annual pruning. A general light thinning-out pruning with cuts well distributed is needed. No large corrective cuts are necessary as main branches are well spaced. Several water sprouts need to be removed from the center of the tree.

carry a crop the lower ones are nearly on the ground. Branches that are too low can be cut off and where they are so long that their ends droop on the ground, they can be cut back to strong laterals of the upward type. Such pruning removes the weak wood and invigorates the remaining wood.

Rejuvenating Old Trees.—Sometimes in a neglected orchard the lower limbs are dwarfed and eventually killed from lack of pruning. The top limbs continue growth unhampered. Under such

conditions the tree becomes too tall. If the lower limbs have been dwarfed but not killed, it is possible that the trees may be profitably lowered. Tall top branches can be headed back to strong side branches. Care must be taken that such a pruning does not leave weak branches at the cut or it may result in bad breaking. Care must also be used that no large opening is made in the center of the tree, because such openings cause sunscald on the main scaffold limbs. Real skill is required for a successful rejuvenation of old

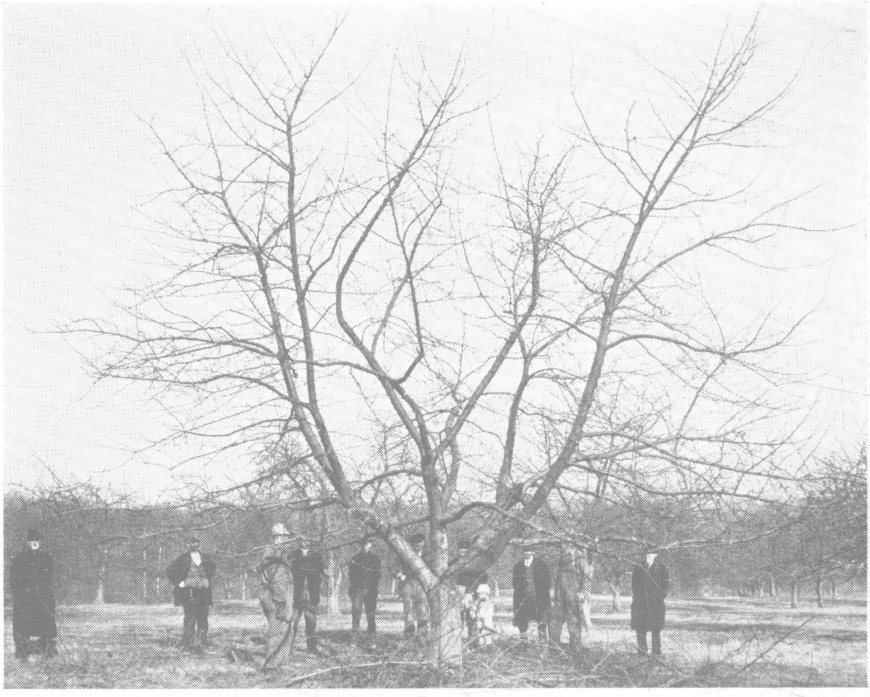


Fig. 15.—Same tree as shown in Fig. 14 after the annual pruning. Water sprouts have been removed and a general thinning-out pruning has been done over all the large branches. Each branch was pruned from top to bottom. Each side branch was thinned from tip end back to base.

trees. If a grower is in doubt as to what to do, he should depend almost entirely on thinning branches in the tops (see Figs. 16-17).

Pruning as Related to Planting Distance.—Trees planted between the permanent ones to increase the production of fruit before they fully utilize the ground are known as filler trees. Such trees are given as light pruning as is consistent with good management to encourage early and heavy production. As they begin to crowd, heavy cutting back of side branches is done only on the fillers, so

that the permanent trees develop symmetrically without the slightest crowding at any time. Cutting-back pruning can be increased in severity on the fillers, flattening them until such time as the permanent trees need all the room. Then the fillers are removed.

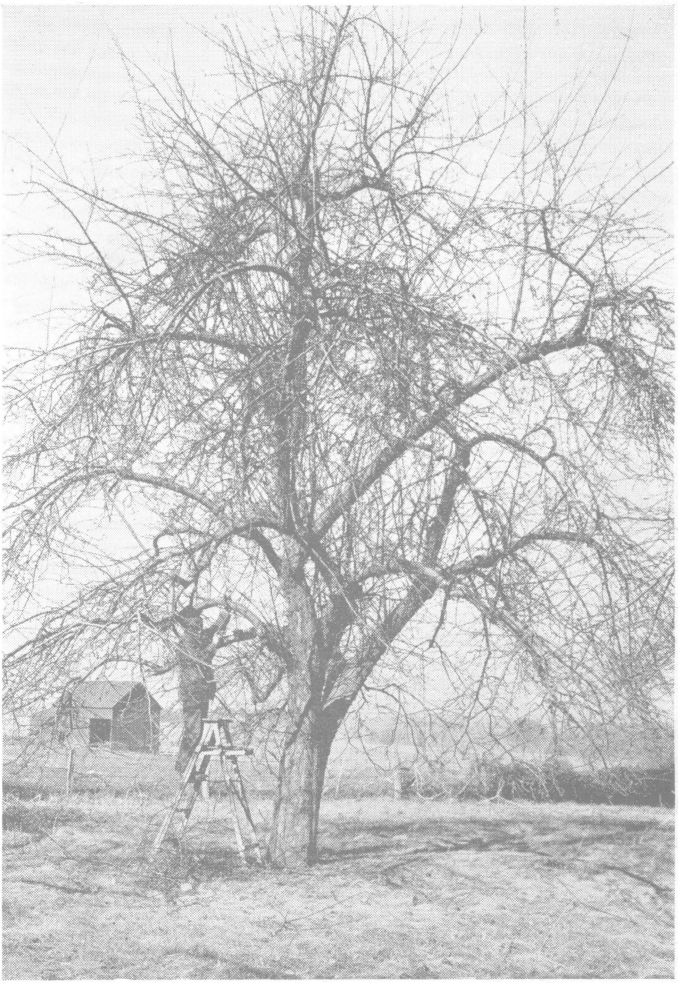


Fig. 16.—An old apple tree in need of rejuvenation. Tree is filled with matted fruiting branches and the center is choked with a dense accumulation of old water sprouts. Some tall branches in the top need shortening. *(Courtesy United States Department of Agriculture.)*

Frequently, orchards of mature trees are found where the planting distance was too small. Trees have become crowded. Side branches interlace. Most of the vigorous growth is in the tops of the trees. The first problem here is to do something to get abund-

ant sunlight on all sides of the best trees. Sometimes cutting out the diagonal rows to stagger the trees relieves the situation. At any rate, devise the best method of cutting out so that the remaining trees have plenty of space around them.

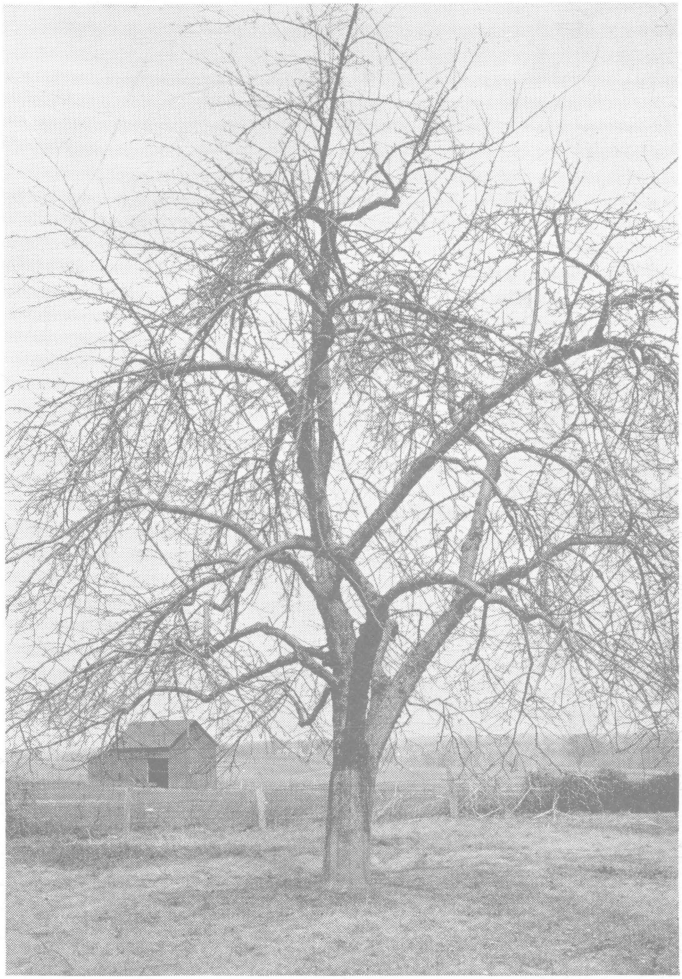


Fig. 17.—Same tree shown in Fig. 16 after pruning. Dead and diseased branches and water sprouts have been removed. Tall branches have been shortened to desirable laterals. A general thinning-out pruning has left vigorous fruiting wood as evenly distributed as possible. *(U. S. Dept. Agr.)*

After a crowded orchard has been intelligently thinned the remaining trees can be pruned. They often produce more and better fruit than could have been secured had all the trees been left.

Pruning Peach Trees Not of Bearing Age

Trees to Plant.—One-year-old peach trees are the best to plant. Each tree has a strong main shoot with several side branches.

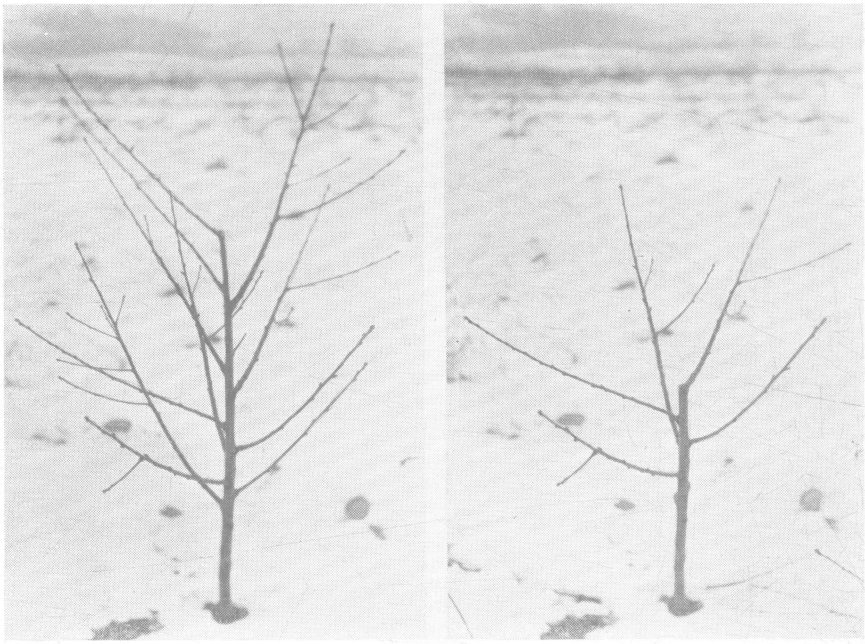
Pruning Young Growing Peach Trees.—After planting, the tree is headed at from 15 to 20 inches; 15 inches is a good average.

(a) *(b)*

Fig. 18.—*(a)* One-year-old peach tree after planting. *(b)* Same tree after pruning. The heavy side branch was removed. The tree was cut back to about 20 inches. Four well-distributed side branches were left and cut back to short stubs to assist in developing a symmetrical open head.

The presence of good side branches should not materially influence the height of heading. If these branches occur a little below the desired height of the head three to five can be used, well spaced around the trunk, and cut back to about 3 inches. Under these branches as spurs helps to develop a symmetrical head. (Compare *(a)* and *(b)* in Fig. 18.)

In the spring at the beginning of the second year select three to five strong well placed limbs for the scaffold branches. Cut off all other branches and remove the center branch to form a vase type open center tree (see Fig. 19 *(b)*). If the growth is very vigorous the tree must be carefully thinned to induce branching low down and to make the basis for a strong sturdy tree which later permits fruiting wood to be formed close in on the limbs. If this growth is not vigorous very little pruning should be done.



(a) *(b)*

Fig. 19.—*(a)* Peach tree after one year's growth in the orchard. In pruning at planting time, tree was headed too high which resulted in weak growth of low side branches. *(b)* Same tree after pruning. Note that central wood has been removed, leaving well-spaced scaffold branches to develop an open-center peach tree. No cutting of side branches has been made.

Branching naturally occurs at the right place and pruning would seriously dwarf an already weak tree.

Like apple trees, young peach trees should be shaped by a light pruning and should not be cut any more than is absolutely necessary to secure this shape.

In some sections of the country peach trees are notoriously early bearers, and under these conditions the pruning does not affect the time of bearing as much as it does the size of the first few

crops. Heavy pruning reduces size of tree for age, and cuts yields correspondingly.

Like an apple tree, an unpruned peach tree assumes a fairly good shape as soon as it bears enough to pull the branches apart. The unpruned tree, however, will have a dominant center branch that soon lessens the growth of small center wood and of the side branches. In addition, this central branch makes the tree higher than if the tree was trained to open center. Hence, it is a good practice to keep the center of the tree opened by removing central branches.

Thinning-out pruning in the summer seems to be one of the best methods of keeping the center open and the tree low. Beginning in midsummer, a few cuts can be made in most young trees to remove the larger center shoots. Such pruning will allow the light to penetrate in to the base of remaining branches and so assist in developing fruit buds in the center of the tree. Such trees come into bearing sooner than if no summer pruning had been done.

Pruning the Bearing Peach Tree

The fruit on a peach tree is all borne on wood of the past season's growth, and the new shoots are grown from terminal buds, or from some of the side buds that did not produce flowers. Hence, the tendency of the tree is to put its shoots at the ends of the 1-year-old wood and to allow the fruiting wood to get farther away from the roots every year. Pruning is one way to correct this situation and to keep peach trees in bounds.

If weather permits, the peach tree of bearing age seldom fails to make enough buds for a heavy crop. In fact, it commonly produces many more than are desired, so that some pruning is advisable for the purpose of thinning the crop. Therefore, the main problems in pruning this fruit tree are to thin the crop and to keep the tree within bounds. Almost any kind of pruning, if it is severe enough, will take care of the latter problem and the amount of wood removed can usually be regulated by the amount of thinning required for the fruit crop.

When and How Severely.—The peach tree should be pruned lightly or heavily, depending upon the fruit prospects. Usually thinning-out cuts can be delayed late enough in the season till the danger of killing the buds is past. Then the trees should be given a thorough thinning-out pruning, followed by any heading back deemed necessary, as described later.

Fig. 20.—Young bearing peach tree before pruning.

In sections where fruit suffers often from spring frosts all heading back can be delayed till blossom time, or even till after the fruit is set. Then, if the crop is lost, the tree may be heavily cut back in order to lower the fruiting wood. However, if the winter is serious enough to injure the wood of trunk and large scaffold branches, the tree should not be pruned at all, and should receive a liberal application of nitrogen fertilizers, to bring it through the coming season to best advantage.

Pruning to Secure Most Favorable Location of Fruiting Wood.—Thin out the wood as seems necessary to let light and air in to all parts of the tree. Usually, these cuts remove wood in the center and top, so that fruiting wood low

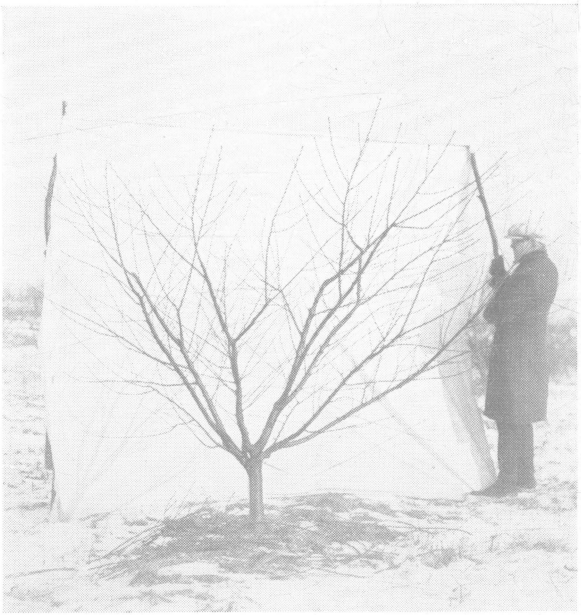


Fig. 21.—Peach tree shown in Fig. 20 after pruning. The bearing wood over the entire tree has been thinned. Tall, heavy wood in the center has been removed to form an open center tree.

down will not be killed out by crowding and too much shade (see Figs. 20 and 21).

Pruning in Relation to Planting Distance.—According to recent investigations of peach pruning, it seems certain that a thinning-out pruning without any heading back is the desirable method to be followed. However, such pruning develops large trees that demand plenty of space and in most bearing orchards such space is not available. Hence, the type of pruning must be partially influenced by the planting distance. When the trees begin to touch at the tips, a method of heading-back pruning becomes necessary. Then a thinning out with a heading back of the terminals must be adopted. However, even under such conditions, it seems desirable to cut to a strong lateral branch rather than to a bud.

Pruning the Sour Cherry

This tree is never as vigorous as the sweet cherry tree, and can usually be depended upon to make a well-shaped tree that is low and spreading. Start the young tree with a low head, following the modified leader type of training as outlined for apples. Use light corrective pruning with young trees.

Fig. 22.—Sour cherry branches showing fruitful and unfruitful types. Branch 1 is from the interior of the tree and received insufficient light. Its growth is slender and unproductive. Branches 2 and 3 were somewhat more favored in location but are too slender for proper fruitfulness. Branch 4 grew at the outside of the tree and received ample sunlight. It developed extensive and plump growth of terminal and laterals and fruitfulness followed. *(Courtesy W. F. Rofkar.)*

Keep main scaffold branches well spaced vertically. Use thinning-out cuts, and where necessary to head back place cut at a strong lateral branch. The leader branch is suppressed when lower scaffold limbs are well established after 2 or 3 years' growth. To do this, the leader is then cut out to a strong lateral scaffold branch.

Like many other trees, the sour cherry becomes very thick if allowed to grow in its own way. The lower branches slow up in growth while the top ones remain very vigorous, at which time the low branches first become unfruitful and finally die, while the top branches remain in a fruitful condition. Thinning-out pruning will delay this dying of the lower limbs, and if combined with a repression of some of the wayward top branches will keep the tree fruitful over a long period.

Strong shoots in the top of the tree begin to start out at odd angles or straight up. Repress these by cutting back to side branches. Then the lower branches will not be shaded as they were prior to the cutting and the whole tree will be more vigorous and fruitful.

Vigorous cherry trees bear the fruit largely on terminals, while less vigorous ones tend to bear more on spurs. Consequently, repressing the most vigorous growth on cherries tends to change the bearing habit of that part of the tree from terminal bearing to spur bearing. Such a change is desirable because the spur-bearing tree is usually less affected by spring frosts and winter freezes, and in the long run is more fruitful than a tree bearing from its terminals.

Pruning the Sweet Cherry

This fruit tree bears on spurs and is usually a very vigorous grower. Consequently, like the apple, it must be pruned to produce good scaffold limbs in accordance with the modified central leader type. Then very little pruning should be practiced till the tree comes into bearing.

With the bearing tree the cuts must all be of a thinning-out type to prevent it from slowing down in its growth. Cutting back to lateral branches as well as thinning may even be necessary to invigorate old trees, but as with the apple the heading back process must be practiced with caution.

Pruning the Pear

The pear has similar growth and fruiting habits to the apple and is pruned and trained in a similar way. For most varieties of pears, the modified leader type of tree is preferred. (Figs. 23 and 24 show the ill-effects of a continuous heading-back pruning. Fig. 25 has been well pruned, and thus kept in annual-bearing condition.)

Fig. 23.—Young pear tree showing undesirable multiplication of branches following continuous heading-back pruning. Only the older, lower bent branches have begun to fruit. Top of tree is too dense for the formation of strong fruit buds. *(Courtesy W. F. Rofkar.)*

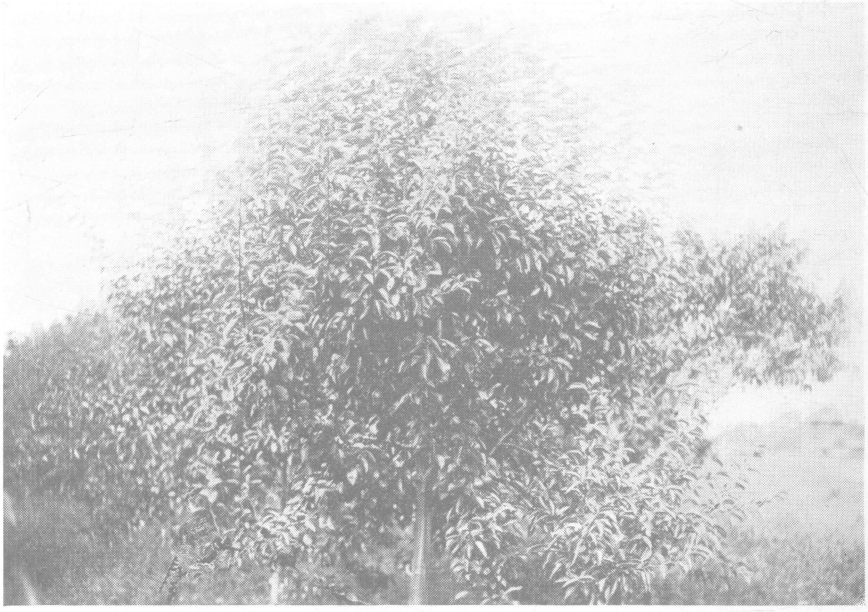


Fig. 24.—Pear tree shown in Fig. 23 in full leaf. Note extremely dense vegetative condition of the top of the tree following heading-back pruning. *(Courtesy W. F. Rofkar.)*

Light pruning of young trees is recommended, as blight is more difficult to control where annual growth is stimulated and softened by heavy pruning.

Cuts and wounds on pear trees, especially cuts made during the growing season, should be promptly disinfected with a 1 to 500 solution of equal parts of bichloride of mercury (poisonous) and cyanide of mercury (poisonous), to prevent entrance of fire blight. (Follow directions on package for making solution of strength indicated.)

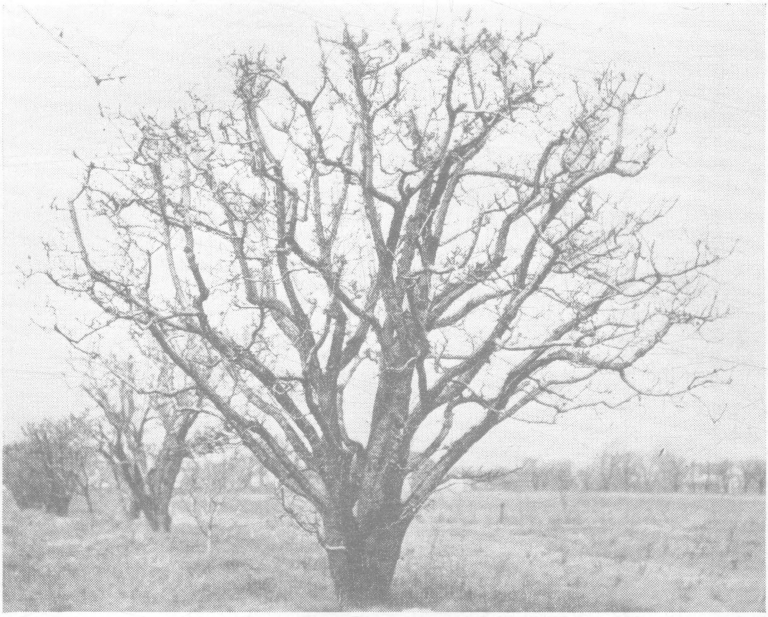


Fig. 25.—Fine old Duchess pear tree standing in Ottawa County, Ohio. Large branches are well spaced to admit light. Tree has been kept in annual bearing by well-distributed pruning cuts that have each year removed about one-third of the fruit spurs. This type of pruning has prevented the remaining spurs from growing uniformly and annual bearing has resulted. *(Courtesy W. F. Rofkar.)*

Pruning the Plum

The bearing habit of plums varies with the variety. Usually, the pruning is intermediate between that for the peach and the cherry. Some varieties of plums grow much like the peach and are treated accordingly. Others are more like the sweet cherry and are pruned in a similar manner.

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